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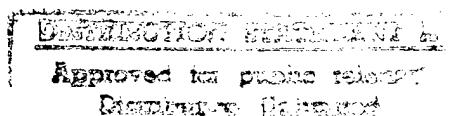
AIR FORCE TOOLBOOK

A Research Paper

Presented To

The Directorate of Research

Air Command and Staff College



In Partial Fulfillment of the Graduation Requirements of ACSC

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Abstract

A vast amount of information about today's United States Air Force is available from numerous sources. Professional military education schools, Air Staff agencies, and many Department of Defense offices identified the need for a single comprehensive source of data about the active duty US Air Force. The organizations requesting the single source product range from military professional organizations with highly trained staffs to organizations training their students on basic Air Force facts.

The Air Force ToolBook project team researched and authored a multimedia encyclopedia (called a "ToolBook") on the current active duty US Air Force. Material included in the ToolBook is similar to that presented in the Air Force Almanac edition of *Air Force Magazine* but to greater detail. The ToolBook includes: airpower doctrine, roles and missions, structure of the major commands, types of hardware, base support services, plus selected future hardware and applications. The project's scope does not include historical information that will be available in another application. Concurrently, the project team designed an Internet World Wide Web (WWW) site with similar information and scope. The WWW site is complete but requires final Air Force approval before release to the public.

The ToolBook is designed to run on a double-speed CD-ROM on a 486/33 or higher class desktop computer with a high color (32K or 64K colors) SVGA display. Although

the ToolBook can be viewed with a 256-color display, some of the pictures may not display correctly. In addition, a sound card is recommended for audio clip portions.

All information in the ToolBook is unclassified. This product is designed as a reference tool for random access, not as a “one-time read and put away” book. This ToolBook combines the most current information about the US Air Force into a clear, concise, multimedia based format that can be used by academic institutions or by professionals in the field.

Chapter 1

Objective

Much data on the United States Air Force is available, but from separate sources. No single source adequately reflects the overall mission, doctrine, equipment, organization, and capabilities of the greatest Air Force in the world. A great need exists to consolidate the available data into one product that discusses the United States Air Force.

The purpose of this research project was to design a multimedia, single-source ToolBook that consolidates current information concerning the active duty US Air Force. The information contained in the ToolBook is unclassified. The target population for the ToolBook is wide-ranging. Many Air Staff agencies and DOD offices expressed interest in a single source project to use as a reference in day-to-day operations. Academic institutions also expressed interest in the product for use in training. The research team designed the ToolBook to be easy to use and to provide the type of information the reader requires. Another aspect of the project was the initial construction of a World Wide Web site.

The WWW site constructed for this technology project is designed to mimic, as closely as WWW and Internet technology allow, the Asymetrix ToolBook constructed for this research project. It is imperative for the reader to understand that this WWW site is complete pending Air Force approval. Future research groups should improve the site by

incorporating new technologies. Over the months it took to construct the project ToolBook and WWW site, Internet browser technology changed greatly and rapidly. Unfortunately, time, budget, and resource constraints prevented the incorporation of the latest WWW technology into this Web site. The WWW site is designed to give people who do not have access to the appropriate ToolBook software, a CD-ROM, and a powerful computer, ready access to current, updated Air Force information. Air University should use this product now to augment academic activities. The WWW site must be approved by official Air Force channels before release to the general public. As of 19 April 1996, the address was: <http://wwwacsc.au.af.mil/beta/index.htm>

Chapter 2

Description

Development

The team used brainstorming and flowcharting to determine final ToolBook design and content. The group identified its target audience, then looked at examples of other ACSC ToolBooks and many commercial CD-ROM hypermedia products to determine what presentation format was best for the user and which techniques to use in this ToolBook. Figure 2-1 is an example of flow-charting.

Considering the results of our initial analysis, the project team divided the ToolBook into five sections: doctrine, applications, organization, hardware, and support. The project team assigned one to three members to develop each section, one member to construct the ToolBook, and one member to author the WWW site. The ToolBook programmer and WWW site author spent many weeks learning how to author in ToolBook and on the WWW. The team completed research by Christmas and converted the information to Microsoft PowerPoint slide format by the end of January. As they received PowerPoint slides, the ToolBook and web page programmers then converted them to the final ToolBook or WWW site form.

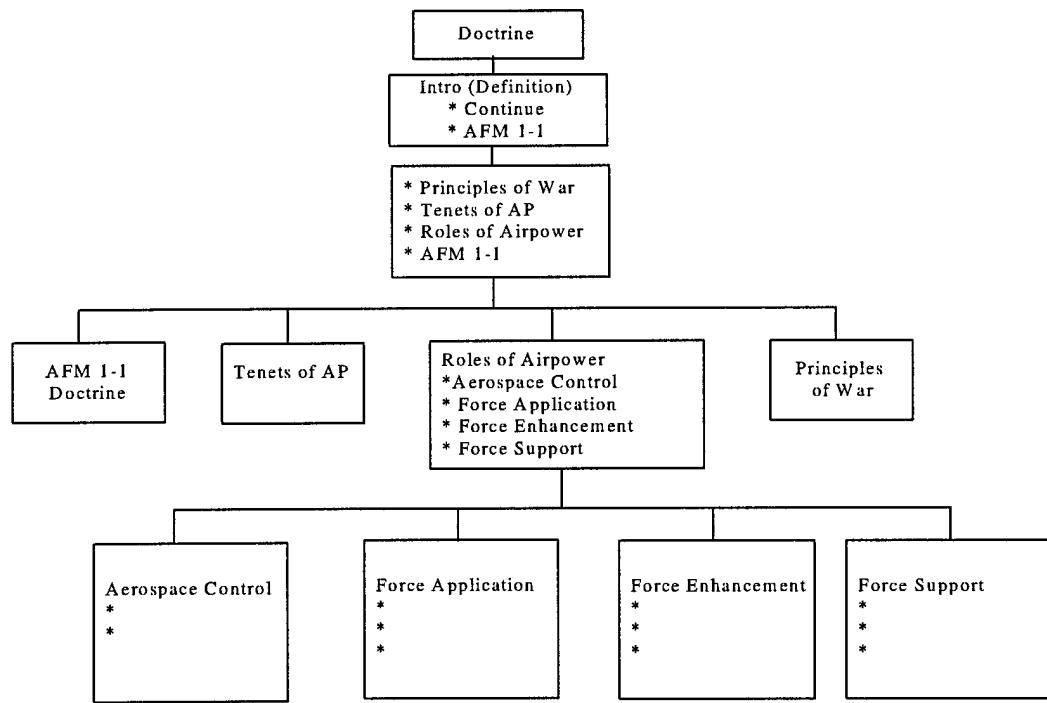


Figure 2-1. Flow Charting

ToolBook Overview

The doctrine section of the book consists of the basic Principles of War and the Tenets of Airpower. Air Force Manual 1-1, Volumes I and II, was the main source document. This section gives the reader an understanding of some basic principles and tenets of warfare, then goes into detail on the application of airpower. The user has the option of reading the entire text of AFM 1-1, Vol I using Microsoft Word Viewer, if so desired.

The application section consists of the airpower doctrinal concepts of aerospace control, force application, force enhancement, and force support. Each section presents information in a graphical format to enhance the user's understanding of the underlying concepts of airpower.

The organization section discusses the structure of the entire US Air Force from the major command down to the wing level. The Air Force Almanac edition of the *Air Force Magazine* and organizational fact sheets provided most of the information in this section.

The hardware section of the project includes all the combat tools (platforms, weapons, sensors) the Air Force uses to accomplish its mission. Again, team members drew much detail from fact sheets and the WWW. Extensive graphics and depictions give the user a real feel for the capabilities of the many weapon systems.

The support section details numerous base activities and services available to meet the needs of Air Force military members and their families. The underlying theme is the commitment of Air Force leaders and commanders to providing good quality of life for their people, so that people can focus on the mission. The section also addresses base support organizations and functions that contribute to the operational mission and base infrastructure.

World Wide Web Site

WWW sites use a specific language known as Hypertext Markup Language (HTML) to display images and text in Internet browsers such as Mosaic, Microsoft's Internet Explorer, and Netscape's Navigator. Project participants constructed this WWW site using a combination of word processing and Netscape Navigator Gold 2.0 (in Beta at the time of this project), which allows a WWW author to construct a Web site in a what-you-see-is-what-you-get (WYSIWYG) environment. This environment minimized the time spent directly writing HTML, a laborious process when using large numbers of graphical elements. Rapidly generating HTML code was an imperative given the massive amount

of ToolBook data that had to be translated and adapted to HTML format. The Organization section alone, for example, has over 200 graphic elements.

Despite the inherent limitations of HTML, the WWW author made every effort to make the Web site as graphical and intuitive as possible, including the use of clickable pictures (see an example in figure 2-2). Appendix A describes HTML limitations in detail. All the user does to navigate through the Web site is to click on an image or icon representing the information desired. This extensive use of graphics, versus the heavy reliance on text, keeps user interest high. The user even has the ability to download key documents (such as a text version of AFM 1-1, Volume I) and captivating videos (in *.avi format) throughout the Web site. The different sections of the Web site contain different background colors to allow the user to intuitively navigate between sections.

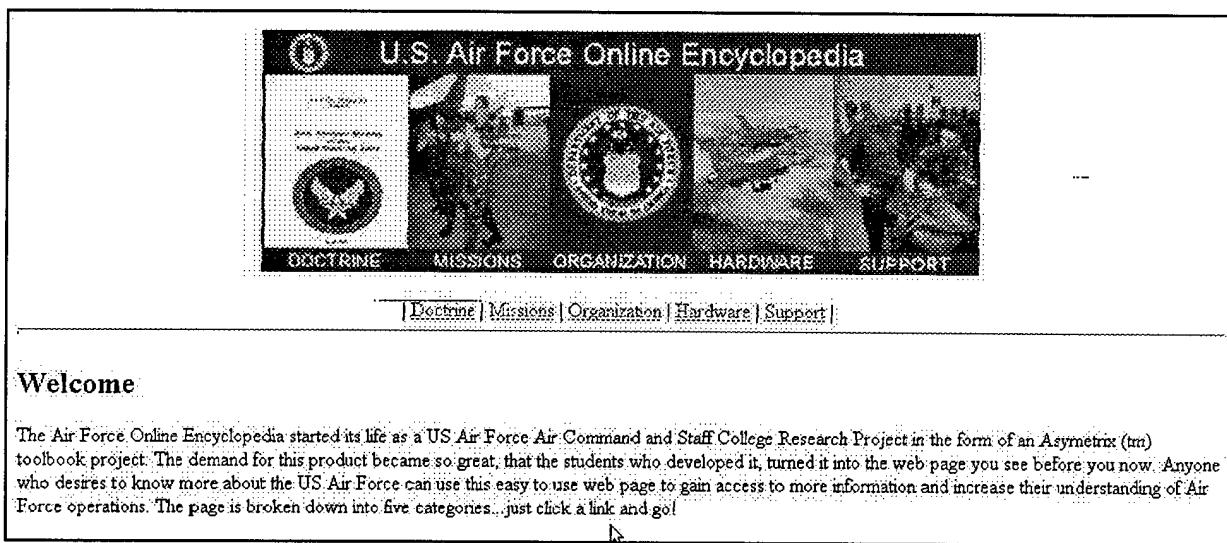


Figure 2-2. Clickable Image Map for the Project's World Wide Web Site

The project team tried to keep image size small to allow for quick transmission of Web site pages through a modem connection as slow as 14.4 kilobytes/sec (kbps). This

design permits users to effectively view the Web site using their home computers and a modem. Obviously, speed concerns diminish dramatically with a local area network (LAN) connection, available through most Air Force bases.

ToolBook System Requirements

The size of this ToolBook makes it suitable for production on a compact disc (CD). As such, the optimum computer configuration is: a Pentium processor, 16 megabytes of RAM, a SVGA high color video card ($640 \times 480 \times 32,000$ colors or better), Sound Blaster compatible 16 Bit sound card, a 4-6 speed CD-ROM, and Microsoft Windows 3.1 or later. This ToolBook will run on a minimum configuration of a 486SX computer with 8 megabytes of RAM, a 256 color video card, CD-ROM, and no sound card but performance will slow and graphics quality will diminish.

World Wide Web Site System Requirements

Optimum computer configuration is the same as the ToolBook, described above. Minimum configuration is the same except that a 386 computer can be used. **Note:** WWW site usage requires a direct connection to the Internet via modem or local area network. Internet browser software requirements are delineated in *Appendix A—Internet Browser Requirements*.

Chapter 3

Assessment

On 20 March 1996 the research team conducted a self-assessment of the Air Force ToolBook research project using the ACSC Research Department evaluation sheet.

Over the last several years, many agencies from the Air Staff and Department of Defense identified a great need for a multimedia almanac type reference product covering the United States Air Force. Also, many academic institutions wanted a reference product to use in training. The research project team designed a unique product using innovative ToolBook techniques, such as video clips and section specific navigation buttons, and the latest WWW technology. This product is a first at ACSC because both a ToolBook and WWW site are now available for the users.

The information contained in both products is thorough and fully integrated, effectively reaching a broad-based audience. The research team did limit the scope of the project to active duty units, wing level, and unclassified information. Detailed information about the Air Staff is beyond the scope of this project.

The overall design of the ToolBook and Web site make them extremely user friendly. The use of tooltips, menu bars, and an overall outline view make this a uniquely easy product to use. All graphics enhance the information contained in the book and simplify the learning process.

Academic institutions can incorporate this product into many courses. The graphic nature of this product will increase the learning process and enhance the depth of knowledge of all graduates. This product will fit very nicely into the Joint Professional Military Education arena and aid joint service members' understanding of the United States Air Force. The research team believes this is a professional contribution to the military services on the whole and will aid many staff agencies and educational institutions in presenting information on the current US Air Force.

Chapter 4

Conclusions and Findings

A multimedia, single-source ToolBook on the current, active duty US Air Force is available to Air University and any requesting agency. A WWW site is also available containing the same information. Both products are easy to use and will greatly aid the learning process. The project team is extremely proud of completing two products this year. During the projects, the research team developed some recommendations for future research teams and for Air Command and Staff College.

It is best to have one person do the ToolBook/WWW editing. The learning curve is steep, and coordinating programming standards (scripting and page naming conventions, comments, etc.) is difficult among people with little formal programming experience. The strategy of having group members design pages in PowerPoint (an application with which most were familiar) and pass those files to the ToolBook/WWW "integrator" worked extremely well. The "integrator" then cut and pasted from PowerPoint to ToolBook, resizing as necessary and adding the scripts to navigate from page to page.

The project team recommends that ACSC standardize and invest in Netscape Navigator as its WWW browser. It is more stable and more capable than Mosaic. Its status as the defacto standard browser means that more WWW sites use its unique capabilities more than any other browser. Netscape Navigator's new technologies, such

as frames, JAVA, and Shockwave should be incorporated into future versions of the Web site. Since the Internet is growing in popularity, availability, and power, the Air Force and Air University should take advantage of the new Internet technologies to increase and improve learning and training opportunities. This may also necessitate an investment in newer software to take advantage of emerging capabilities.

The project team recommends that ACSC keep the Air Force ToolBook updated on a yearly basis. The product is current for 1996 but with the current force cuts and reorganizations, the data will require updating on a regular basis. The WWW site requires the same attention.

Appendix A

Technical Development Topics

This appendix includes lessons learned by the research team. The intention is that future research teams can learn from these topics and begin their projects at a more advanced stage. The project team included solutions but stresses that there are more ways to solve the problems.

General

ToolBook development is not a quick process. Creating the layout for a page is relatively straightforward, and pages can be cut and pasted for quick duplication. However, copying scripts from one page to another is more cumbersome, and scripts usually require editing to change names of referenced objects and pages.

The project team found that ToolBook does not handle pasted text from other applications very well. Text pasted into fields in ToolBook invariably picked up unwanted combinations of bold and non-bold type, as well as a string of “garbage” characters at the end. Also, font sizes and typefaces did not transfer, and had to be changed after pasting.

Graphics imported to ToolBook cannot be reissued without cropping. A workaround to this is to create a button object, then apply the graphic to the button, with the “stretch

to fit” property set to “true.” While this technique is effective, it is very labor-intensive. A better solution is to first insert the graphic into another application, then cut and paste it into ToolBook. This works because pasted objects or pictures can be resized.

The team found that ToolBook is somewhat unstable and unpredictable. It would frequently cause General Protection Faults (GPFs) in Windows, forcing a reboot and loss of all unsaved work. Once when this occurred, it even corrupted the previously saved version on disk, forcing the team to revert to an even earlier version.

Another time, ToolBook began giving I/O errors when attempting to advance to the next page, or when attempting to save the file. Incredibly, clicking on the “cancel” button in the dialog box that announced the error brought up a second dialog box which said “False alarm! Harmless internal error” with an “OK” button. However, clicking on the “OK” button merely closed the dialog box. The team still could not flip to the next page or save the file. The only recourse was to exit ToolBook and start again with the most recent saved version.

The project team soon learned to save often, and to keep many incremental versions so that a file corruption problem would, at worst, cause us to revert to a version that was fairly recent. The programmer also backed up work on two different hard drives.

Many of these problems seemed to be related to Windows 3.1’s poor memory management. The project team found that the fewer applications open while editing the ToolBook, the better. As the ToolBook grew in size, however, it became increasingly difficult to run the PowerPoint, graphics programs, and the ToolBook application simultaneously. The project team solved this problem by shifting development to a

student personal computer, running Windows 95. Windows 95 is much more efficient in allocating memory, and it provided a very stable development platform.

ToolBook Authoring

The biggest challenge with the ToolBook was palette shifting. On a computer with an 8-bit color video VGA setting (the minimum standard for Multimedia), Windows uses a palette of 256 colors chosen from a possible 16,000 (or more, depending on the type of video card). At any given time, that subset can change, depending upon what shades a particular picture or object requires. If two objects are being displayed which require different palettes, Windows and the application will try to find the “best match” and create a “compromise” palette. Often this results in one or more objects on the screen taking on a psychedelic appearance with distorted colors on photos and graphics.

To make matters worse, ToolBook’s routine for managing the palette seems particularly inept, and almost random at times or team training did not prepare them to handle this problem. For example, a picture inserted on one page will display fine, but when cut and pasted from that page to another, it will take on a bizarre palette shift. In other cases, a picture may look acceptable the first time a page is viewed, but after switching to another page, then back again, the colors shift. This problem was especially evident on the ACSC-supplied laptops. Pages that were at least acceptable on desktop systems were, in some cases, unrecognizable on the laptops.

One technique that worked in a few cases was to combine the objects in another application (working in 24-bit or “true color” mode), create a bitmap (.bmp) of the combined images, reduce the color depth of the new image to 256 colors, then paste it

into the ToolBook. While this would not necessarily keep the colors from shifting, it would at least ensure that colors on the multiple images shifted uniformly. The downside of this technique is that now the objects could not be manipulated individually within ToolBook. The technique is also very time-consuming.

In many cases, this limitation of ToolBook and Windows was insurmountable based on team knowledge, training, and available software. The only way to be certain that the colors are normal is to view the ToolBook on a computer running in a color mode greater than 8-bit (32,000 or more colors). Most desktop computers at ACSC are capable of this. Also, since the product is targeted for distribution via CD-ROM and is not intended to be used on ACSC laptops, the team feels most target computers will have video cards capable of displaying more than 256 colors.

Another big constraint was color depth. This is not because of palette shift, as described earlier. Rather, it affects the perceived speed of the resulting product. Pages with 24 bit (16 million) color images loaded very slowly, even on the Pentium-class computers. The team reduced the color depth on all scanned photos from 24 bit to 8 bit before inserting them into the ToolBook. This made a dramatic difference in page setup speed and storage size of the project.

Another challenge was sharing “work in progress” effectively. As the ToolBook grew, it was increasingly difficult to pass it among members of the group. Because Windows for Workgroups (a subset of ACSC’s LAN) did not make reliable connections from seminar to seminar, the project team was forced to send the file as an attachment to an E-Mail message. This not only was slow, but also took up a great deal of space on the mail servers.

The project team was later granted space on the ACSC FTP (File Transfer Protocol) site to temporarily store work. This was a big boost, because the team could then transfer the ToolBook from the seminar computer to the FTP site, and then to another seminar or laptop computer. In most cases, transfer speeds were acceptable. During evening or weekend periods, transfers were extremely fast. For example, a 14MB file would transfer in about 1.5 minutes.

A similar difficulty arose when transferring video clips. The only transfer method for video capture was E-Mail, as the video capture computers at ACSC lacked both Windows for Workgroups and Internet connectivity.

Research Material

Tracking down wing-level information was a major challenge. With the amount of reorganization occurring in the Air Force over the past several years, up-to-date mission information was not readily available. The team contacted the HQ USAF Public Affairs office to get current information on Air Force wings but they referred the team to their source, the *Air Force Magazine*. The PA offices at the major command levels were more accommodating and Air Mobility Command, Air Force Materiel Command, Air Education and Training Command, Air Force Special Operations Command, and Air Combat Command sent packages of fact sheets with their latest information. Air Force Space Command did not have current information, therefore, the team contacted each unit directly. The Internet was also a source of information on some wings, but only a few Air Force wings have home pages that include a mission description.

Finding usable pictures was a major endeavor. Once acquired, photos had to be individually scanned and touched up in a paint program. Two major setbacks occurred during budget-related government shutdowns. This caused a two month delay in receiving the full compliment of pictures.

Much research came from the Internet, but it required extensive, time-consuming, editing and reformatting. Most of the sources were individual UNITS ON LINE and Air Force Public Affairs. Another time-consuming endeavor was putting all the data into PowerPoint graphic presentation slides for easier transition to the ToolBook. This filled up precious space on laptop hard drives, forcing most team members to do the majority of their work on seminar Pentium workstations. Transferring data proved to be frustrating and time-consuming. Many sections have massive files, unable to be downloaded on disks, and with the Windows for Workgroups limitations, took many tries to send over the network.

Another last minute problem was WWW credit documentation. Initial guidance made the WWW public domain with no citation required. Three-quarters of the way through the research, the project team received clarification on the guidelines, which resulted in revisiting each of the Internet sites to collect detailed addresses. The implications required going back and finding every reference from the Internet.

Video Clip Processing

One of the most significant limitations the group faced was not having video capture capability until very late in the project. ACSC should configure hardware and train their ToolBook teams on video capture within the first few weeks of project assignments.

ToolBook vs. HTML Capabilities

WWW site technology does not allow for the same level of interaction between user and computer that the ToolBook program permits. As a result, the WWW pages are static in their nature, though the information contained in the WWW site and the ToolBook portions of this research project are essentially identical. For example, there is no way with HTML technology for different picture and graphical elements to appear merely by moving a mouse cursor over an area of the screen as can be done with a ToolBook. Additionally, there is no way to incorporate movies or moving graphics seamlessly into a Web site without using leading edge Internet browser technologies. Those technology packages can cost as much as \$3,000. Time and resource constraints also prevented the incorporation of those graphic elements. The benefit to using a Web site, however, is that the Web site will run efficiently even on a low-end 80386 computer with as little as eight megabytes of random access memory (RAM).

Internet Browser Requirements

To make full use of colored backgrounds, clickable images, and advanced formatting, the user **must** use one of the following Internet WWW browsers to view the Web site:

- Preferred—Netscape Navigator version 2.0 (Commercial software for most users, but free for educational institutions such as ACSC.)
- NCSA's Mosaic version 2.0 (The release version, freeware)
- Microsoft Internet Explorer version 2.0 (The release version, freeware for Windows 95 and Windows 3.1)

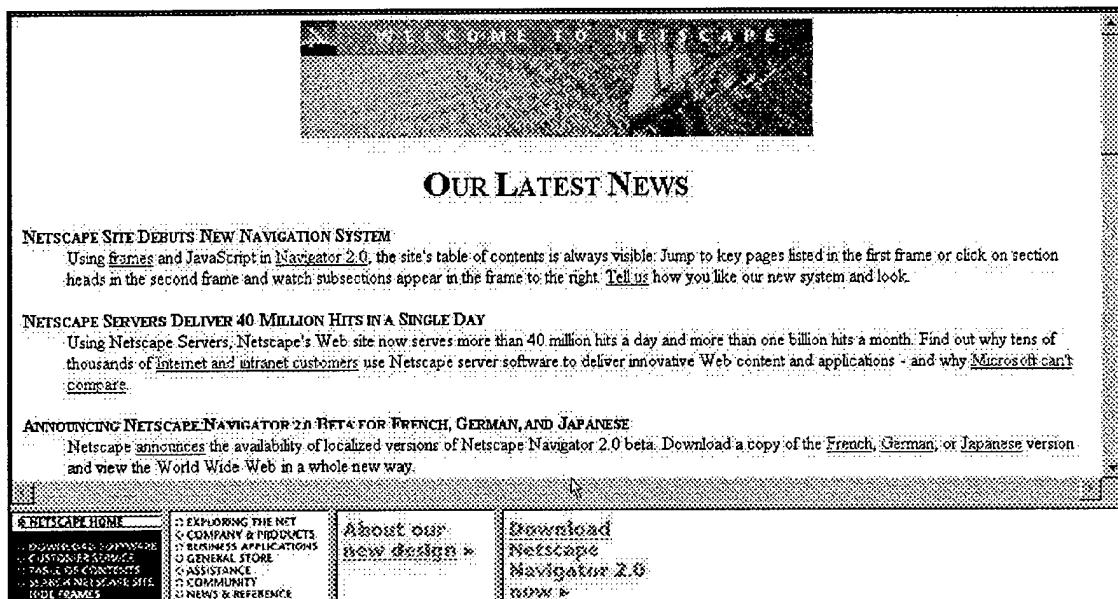
Each of these browsers uses a slightly different version of HTML version 3.0, which as of this writing, has yet to be standardized. Failure to use one of these browsers in the correct

version will result in distorted backgrounds, and improperly displayed graphics and text. Netscape is the de facto standard for Internet browsers, though it does have many formatting extensions not supported by most other browsers. In using Netscape Navigator Gold to minimize Web site development time, the author noted that problems existed in centering graphic and text elements between different browsers. If a user viewed the site with Netscape Navigator, all elements would appear correctly on the screen. If one used the other two browsers, graphic and text elements would not be properly centered. To resolve this problem the WWW author was forced to manually edit the HTML code to "standard" HTML (now known as HTML 2.0).

Web Site Technology

As stated earlier, there are many emerging WWW/Internet technologies that the project team could not incorporate into the Web site. One of these technologies that can be incorporated into a future version of the Web site is Netscape frames (see figure 3-1 for an example). Each frame has all the capabilities of a browser in and of itself. In other words, each frame can change to different graphic elements or information completely independent of the others on the screen. Movies and animations can be showing in one or more frames, while the user is simultaneously navigating through another. While frame technology does not require the use of expensive software to employ, time constraints and steep learning curves kept the WWW author from employing it in this research project. Employing this technology would increase user interest and allow for quick navigation through the Web site.

Unfortunately, employing movies and animations directly (“streaming”) into the web browser screen (or frames) itself is a brand new technology, known as Shockwave, that requires expensive software (list price approximately \$3,000 and produced by Macromedia, Inc.) to exploit. Barring this fiscal challenge, the process to produce animations is very complex. Similar constraints apply to incorporating the latest three-dimension and Java applications (which provide other types of animations).



Source: <http://www.netscape.com>

Figure A-1. Netscape Frame “Window”

Web Site Graphics Challenges

Incorporating graphics into the web pages was the most time consuming task for the development of the Web site. Graphics files of organizational emblems had to be reduced in size, and altered so backgrounds were transparent, allowing the background color of a web page to show around the graphic. The WWW author used a 90-MHz Pentium computer and the latest Windows 95 software (not available to most students at

ACSC) to prepare the graphics for the Web site. This graphic manipulation often slowed the computer down to a crawl.

In summary, ToolBook and WWW site development is both complicated and time consuming. There are software and hardware limitations to overcome as well as interface constraints between various development components (PowerPoint slides, video clips, e-mail, etc.) to consider. To successfully produce a quality product despite these roadblocks requires early and extensive training and tenacity.

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